DR-21. INVESTIGATION OF ZINC SELENIDE THIN FILMS PRODUCED BY CHEMICAL BATH DEPOSITION

A. A. Timina[1], L. N. Maskaeva[1,2], V. F. Markov[1,2], K. A. Karpov[1]

[1] Ural Federal University of the first President of Russia B. N. Yeltsin,
Mira St., 19, Yekaterinburg, 620002, Russia

[2] Chemistry and Combustion Process Department,
Ural State Fire Service Institute of Emergency Ministry of Russia,
Mira St., 22, Yekaterinburg, 620022, Russia

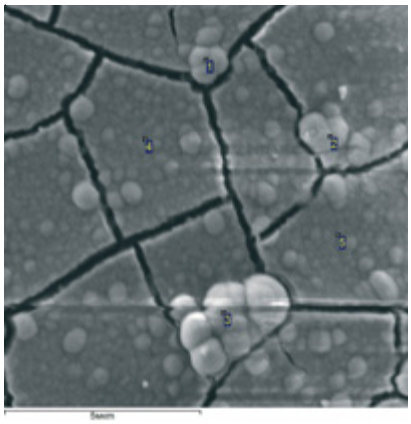
E-mail: aatimina@mail.ru

The most perspective from typical wide-band gap representors of semiconductor $A^{II}B^{VI}$ compounds is zinc selenide. Zinc selenide can be used in creation of semiconductor electronic devices and information display systems, active laser medium, color TV screens, optical light modulators and other optoelectronic devices.

Many researchers prefer simple in technical performance method of chemical bath deposition from aqueous mediums to obtain selenide ZnSe thin films. Sodium selenosulfate Na_2SeSO_3 or selenourea N_2H_4CSe can be used as selenium ions supplier. But due to high cost and low stability of selenourea the first chalcogenizer is preferable.

ZnSe thin films deposition was carried out from the reaction mixture containing calculated volume of zinc chloride $ZnCl_2$, sodium citrate $Na_3C_6H_5O_7$, hydrochloric acid hydroxylamine $NH_2OH \cdot HCl$ and sodium hydroxide NaOH. Chalcogenizer was sodium selenosulfate Na_2SeSO_3. Synthesis temperature was 353 K, duration of the synthesis was 120 min, substrate material – sitall.

By using of energy-dispersive microanalysis of whole area of analyzed sample the concentration of main elements (Zn, Se) in freshly-deposed thin filmed selenide was determined. On electron microscopic image local areas in which analysis was carried out are shown.



№	Elements , at.%	
	Zn	Se
1	50,35	49,65
2	50,90	49,10
3	54,91	45,09
4	51,09	48,91
5	50,96	49,04
Average	51,64	48,36

The results of energy-dispersive analysis of ZnSe film obtained by chemical bath deposition from the reaction mixture, mol/L: $[ZnCl_2] = 0{,}03$, $[Na_3C_6H_5O_7] = 0{,}35$, $[NH_2OH \cdot HCl] = 0{,}36$, $[NaOH] = 0{,}99$, $[Na_2SeSO_3] = 0{,}04$. Temperature – 353 K, duration of the synthesis – 120 min

As a result of EDX-analysis we should conclude that in deposed ZnSe layers there is no stoichiometry ratio between main elements: Zn and Se (51,64 and 48,36 at.%). Also, cracks are shown which are on the surface of analyzed chalcogenide film. It can be explained by mechanical tensions appearing in film due to difference in coefficients of thermal expansion of film and substrate: zinc selenide film $\alpha_{ZnSe} = 7{,}1 \cdot 10^{-6}\,K^{-1}$ and sitall substrate $\alpha_{sub} = 5{,}0 \cdot 10^{-6}\,K^{-1}$.